

Ultrasound Imaging of Spine: State of the Art and Utility for Space Flight

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Introduction

Ultrasound imaging (sonography) has been increasingly used for both primary diagnosis and monitoring of musculoskeletal injury, including fractures. In certain injuries, sonography has been shown to equal or surpass Magnetic Resonance Imaging in accuracy. Long-term exposure to reduced gravity may be expected to cause physiological and anatomical changes of the musculoskeletal system, which are not fully described or understood. In a limited-resource environment like space flight, sonography will likely remain the only imaging modality; therefore, further attention to its potential is warranted, including its ability to image anatomical deviations as well as irregularities of vertebrae and the spinal column.

Methods

A thorough review of literature was conducted on the subject. A multipurpose ultrasound system was used to identify specific vertebrae, intervertebral disks, and other structures of the cervical spine in healthy volunteers, selected to represent various age, gender, and Body Mass Index (BMI) groups. Sonographic views were sought that would parallel radiographic views and signs used in the diagnosis of cervical spine injuries.

Results

While using widely accepted radiographic signs of cervical spine injury, this sonographic protocol development effort resulted in successful identification of scanning planes and imaging protocols that could serve as alternatives for radiography. Some of these views are also applicable to diagnosing degenerative disk and bone disease, and other non-traumatic spine

pathology. Strong, preliminary correlation has been demonstrated in a number of clinical cases between sonography and other imaging modalities.

Conclusion

In the absence of radiography, sonography can be used to diagnose or rule out certain common types of cervical spine conditions including injury. Clinical validation of the findings appears to be realistic and would facilitate establishment of new sonographic protocols for special environments with lacking radiographic capability, such as human space flight.